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NATIONALIZATION

HEADMASTER SHINWELL has a very large class in his Nationalization Preparatory School; the pupils at the moment—back room and front room boys—number 8,338, in spite of comings and goings. This represents a large number of students who presumably are being fitted adequately for the tasks which lie ahead. We mention this small fact in view of two aspects of the nationalization situation, the first being the Minister of Fuel and Power's speech on Friday last as chief guest of the British Electrical Development Association. On this occasion Mr. Shinwell said there were some people connected with the Electricity Industry who had presented a challenge to the Government. The Government, he added, could not allow itself to be intimidated by any such challenge. The Electricity Industry must, he emphasized, be "brought under the umbrella of some form of national ownership, and use the ability and technical qualifications and undoubtedly high skill of those who were now associated with the Industry. . . . The ultimate intention was to make electricity available to everybody." This contention was met with a certain amount of criticism, even though the Minister was chief guest of the E.D.A. It was suggested that Mr. Shinwell had revealed nothing about the legislation which was to govern the future of the Industry.

The second aspect of this question of nationalization concerns the attitude of the British Gas Council, which, as we have already recorded in our columns, neither supports nor does not support nationalization as an economic principle applicable with advantage to the affairs of the Gas Industry. This in itself is hardly expressive of a thoroughly positive attitude. Again, as we have already mentioned in these columns, the Council has intimated to the Ministry of Fuel and Power its consistent willingness to maintain in any interim period the development of gas supply to the public, and during this period to discuss the detailed implementation of the Government's policy—a policy as yet quite undefined in detail, irrespective of the number of pupils at the Nationalization Preparatory School. For some time past, and the weeks flow on smoothly or otherwise, the British Gas Council has remained somewhat silent, but we learn from good authority what we have appreciated for some time—that the Government's nationalization programme has created unsettlement in the Gas Industry. The British Gas Council suggests that it worries and distracts everybody, and takes attention from more urgent and vital matters, such, for example, as the provision of food for the people. As a result of its deliberations the British Gas Council urges that the Government should postpone any plans for the nationalization of the Gas Industry for two or (we gather from conversations with those in responsibility within the Industry) three years.

We have mentioned the comments at a luncheon of the Electrical Development Association as to that industry's state of suspense and anxiety. We believe that the Gas Industry is also in a state of considerable anxiety regarding the projects which it might well put in hand without delay were it not for the restrictions imposed on this work by the Ministry of Fuel and Power, who, having arrived at no definition of its plans, seems to us to be seeking alternatives of a wholly antagonistic nature. In the first place it has requested, and the Gas Industry has agreed to do its best to fulfil these requests, that gas undertakings individually should proceed with plans which they think are in the best interests of the consumer. We have been told that gas undertakings have applied for sanction to carry out work which they themselves consider of importance, but have been left and are being left completely in the air. This, of course, is not to our mind helping the consumer in the very least, and in our opinion savours considerably of slipshod method.

During recent weeks we have published the comments of the chairmen of gas companies in their speeches at annual meetings, and almost without exception they have strongly disapproved of any form of nationalization, maintaining that private enterprise has justified itself by its results. Similarly, we have published the views of certain municipally owned undertakings on the question, and some of them, as yet only a few, have had a majority vote in favour of nationalization. How far their viewpoint has been influenced by political considerations we do not know, but maybe the municipally owned gas undertakings are in a half-way state between private enterprise and complete nationalization, and they may in the future view some of their findings as being prematurely dogmatic. In the meantime we have the British Gas Council's full assurance that while it does not support nationalization, it desires that the Gas Industry should, in co-operation with the Ministry of Fuel and Power, be allowed to develop on evolutionary lines. This, of course, necessitates the expedition of permission to proceed with schemes of development and early decisions concerning the financing of such schemes. When and in what form is the necessary sanction to be granted?

"INEFFICIENCY"

THE Gas Industry has always prided itself on its efficiency; so also must it be said have many other industries. Very often it requires an outsider to decide whether or not it is efficient, for it is traditionally difficult to see the wood when one is closely encompassed about on every side by trees. The Gas Industry may take comfort from the fact that it has been put under the microscope twice during the last year by critics who have no reason to be polite in their criticisms—and it has come out well. The Heyworth Committee came to the conclusion that the Gas Industry is efficient as a whole, though, as everyone would admit, there are certain spots which require improvement. Mr. Oliver Lyle, in a Paper to the Institute of Fuel under the title of "Inefficiency," has examined the whole range of British industry, and has reached the conclusion that the overall efficiency from coal to useful heat or energy is only 2.2% in power, this including both power stations and private generating sets; that it is 17% in non-industrial and domestic coal; that it is 23% in industrial heating; and that it is 38% in the production and use of gas and coke.

Feelings of complacency may well come over us from so handsome a testimonial from an investigator so unbiased as Mr. Lyle, but any such feelings must be repressed. The extent of our coal reserves is such that it is probable according to all recent announcements and estimates that we shall be facing imminent exhaustion of our coalfields within 100 years. It is quite true that we may by then have other sources of power and heat, and indeed there are certain other sources of power which are already available though we have not put them to any useful purpose. This is largely because coal has been cheap in the past. Until we have adequate sources of power and heat to replace raw coal we dare not use coal inefficiently. Moreover, even if coal is no longer needed for power generation or for heating, we may very likely require it as a source of carbon for the chemical industry. No man can know what the future will bring forth, and it would be in the last degree foolish to adopt the view, put forward by certain of those who are more concerned with the sale of coal than with its efficient use, that there is no need to economize because "something will turn up." The combined overall efficiency of the use of coal, according to Mr. Lyle, is 18%, and when this is adjusted for

the loss in mining it falls to 15%. Although individual figures may be criticized, it was generally agreed by those present at the meeting that Mr. Lyle's figures are broadly correct.

It is necessary therefore that all industries should look closely into their fuel utilization practice to discover if by any means it can be made more efficient. No doubt gas engineers could say a great deal about the inefficiency of other industries, but it is well that the cobbler should stick to his last. If the Gas Industry can find means for improving the efficiency of other industries by the increased use of gas and coke in those industries, then it is entirely legitimate that it should do so. There can be little doubt that in spite of the work of the Fuel Efficiency Committee of the Ministry of Fuel and Power there is still a very great deal of waste in industry, and this waste can be reduced materially by the increased use of gas and coke in proper circumstances. To some extent the saving of heat that can be achieved within the Gas Industry is dependent upon what is done elsewhere. This is particularly so in connexion with the insulation of buildings and of houses. It is regrettable to find that the houses that are now going up are not being insulated. The Ministry of Works and the Ministry of Health have stated in the *Housing Manual* that houses should be built to a coefficient of $U = 0.15$ in the outer walls, and this means an 11-in. cavity wall with insulation on the inside. We have taken the opportunity of examining every house under construction that we have seen, and although quite a number of them have the 11-in. cavity wall ($U = 0.3$), we have yet to come across one which has been built to the standard $U = 0.15$. We understand, moreover, that the supply of domestic appliances has been passed over to the Ministry of Supply, and that that Ministry is paying no attention to the new appliances that are available, but is simply ordering appliances of pre-war standard in thousands. Instead of this problem being handled in accordance with the known scientific and technical principles which have already been established by the Egerton Committee and others, it appears to have been handed to commercial buyers who are not likely to know or to appreciate the technical problems involved in the efficient use of fuel. With insulation of houses and the supply of really up-to-date appliances for burning gas and coke, there is no question but that the present efficiency of carbonization and its products of about 38% suggested by Mr. Lyle could be raised considerably.

How far the carbonizing process could be made more efficient thermally is another matter which should receive attention. Mr. Lyle has put the efficiency of carbonization at 73%, which means that the calorific value of the products is 73% of that of the raw coal charged to the retorts. A modern gas-works should have an efficiency of 80% according to figures published by Dr. E. V. Evans. We have no doubt that there are some works which are well below 70%, and that it is quite likely that the thermal efficiency all over the country all the year round is something of the order of the 73% suggested by Mr. Lyle. The efficiency of the coke oven process is given by Mr. Lyle as 82%. When the Gas Industry is further reorganized by greater concentration of plant in large central works, it is probable that the efficiency of carbonization can well be improved from 73% to 80%. We are left with the comforting thought that of all processes for the use of coal, carbonization is the most efficient. It is necessary, however, that we should labour mightily to keep the lead which we have secured.

Lieut.-Col. J. A. Gould asks us to correct a passage in his contribution to the discussion on "Education and Industry" at last month's meeting of the Southern Association of Gas Engineers and Managers (Eastern District). What he said was that the London gas companies had found it impossible to supply "instructors," not "students," as reported in last week's "JOURNAL."

The Price of Gas to large factory consumers at Oldham is to be reduced after the March quarter meter readings. In place of the present scale, which allows reductions after consumptions of not less than 150,000 cu.ft. in the preceding twelve months, a block scale is to be introduced, starting with consumptions of 50,000 cu.ft. per quarter at 10.6d. per therm, with a discount of 0.889d., and ranging to 20,000,000 cu.ft. and over, for which the price will be 7.3d. per therm, with a discount of 1.3d.

Personal

Mr. W. J. G. DAVEY, B.Sc., has relinquished his appointment with the Lighting Division of W. Parkinson & Co., Ltd., to take up new duties elsewhere.

* * *

Mr. J. DEMAIN, Engineer and Manager of the Spalding Gas and Water Department, is retiring at the end of this month. He went to Spalding from Ripon in 1928.

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Mr. E. H. HEARNDEN, Works Superintendent of the Wellingborough Gas Light Company, was the successful Independent candidate in the Wellingborough Eastern Division in the Northants County Council elections.

* * *

Mr. C. G. G. BOSWOOD, formerly Secretary and General Manager, Mr. A. S. GILL, and Mr. C. E. G. NYE have been elected to the Board of George Cohen, Sons, & Co., Ltd., as Special Directors. Mr. R. S. FERRY has been appointed Secretary.

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Recent changes in the executive personnel of the Exmouth Gas Company have resulted in the appointment of Mr. W. E. DEAN, formerly Engineer, Managing Director, and Secretary as Managing Director and Secretary. Mr. J. W. DEAN is now Engineer and Manager.

* * *

Mr. DAVID L. DICKSON, Engineer and Manager of the Airdrie (Lanarkshire) Gas Department, has been appointed to a similar position at Kirkcaldy. Mr. Dickson, who is 38, started his career at Kirkintilloch, and after seven years he went to Cowdenbeath.

* * *

Mr. WALTER T. DUNN, who retired from the Secretaryship of the Institution of Gas Engineers in 1929 after 32 years' service with the Institution, has just returned to his home at 72, Elphinstone Road, Hastings, after a series of operations in a St. Leonards Hospital, to receive the remainder of his treatment towards convalescence after five months' indisposition.

Obituary

The death has occurred of Mr. W. BENNETT at the age of 76, after an illness extending over four years. Mr. Bennett joined the Bournemouth Gas and Water Company in 1903, and was associated with the late Sir Arthur Duckham and Colonel H. W. Woodall in the experimental work on the first W-D. continuous vertical retorts at Bournemouth. He subsequently joined the Company formed to exploit this invention and remained with them until his retirement in 1941. His work with the Woodall-Duckham Company was devoted to the operating side of the business, and he was well known in the United Kingdom and several foreign countries. As a young man he spent 21 years in the Royal Navy, and was serving aboard H.M.S. "Calliope" at the time of the Samoan hurricane in 1889 when she was the only one which escaped from Samoa Harbour. In 1939 he took part in the Jubilee celebrations of this event in London and was one of the few living survivors.

* * *

The death occurred suddenly on Mar. 9 of Mr. F. W. Bailey, who had represented Messrs. J. & J. Braddock for many years. He will be greatly missed by his colleagues and his many friends in the Gas Industry.

Letters to the Editor

Shelter Demolition and Gas Main Fracture

DEAR SIR,—The warning which you gave in your issue of Mar. 6 against the method employed in the demolition of surface shelters is timely and, from our experience, most necessary.

A short time ago the machine to which you refer was used by one of the local authorities in our area of supply, with the result that a main and some services were broken. As soon as the cause of the damage was brought to our notice, urgent representations were made to the local authority, and the request was made that the use of the machine in the vicinity of gas mains and services be discontinued forthwith. We were informed that the method of demolition in question was evolved by the Home Office, and was in operation in many parts of the country; but I am glad to say that we were also informed that arrangements would be made for the completion of the demolition work in the particular area concerned to be carried out by other means. I may add that the local authority gave us the official order for us to effect the necessary repairs.

South Metropolitan Gas Company, Yours faithfully,
709, *Old Kent Road, S.E.* 15. F. G. BREWER,
Mar. 12, 1946. Secretary.

Plain Speaking

DEAR SIR,—I was interested to read in the "JOURNAL" of Mar. 6 a letter from Dr. Foxwell putting forward his views about the criticized first report of the Gas Research Board on Radiant Heating.

I think there is some confusion. Dr. Foxwell does not appear to realize that the document criticized is a *report*, not a paper. In fact, on the first page it is stated that it is a report presented to the Council of the Gas Research Board, which surely is a Scientific Body in the sense meant by Dr. Foxwell towards the end of his letter.

The solution of this controversy would appear to be that the Scientist's report to the Scientific Body should be in language and arrangement of his own choosing. He is thus given freedom to spread himself, and to communicate all the work which he has patiently undertaken. I would agree with Dr. Foxwell that such reports are not always easy to read and understand. Surely it is now the job of another specialist to take the report in hand, and from it make a paper for presentation to a society of technical (but not specialized) personnel. In this way a restriction on the authors to adopt basic English would be avoided, and at the same time scope given to some literary-minded person to form the report in language which he feels would have much wider appeal.

I fear that if Dr. Foxwell's suggestion that "busy engineers and managers want the egg without the cackle," their egg would often prove to be an indigestible meal of mathematical symbols and formulae.

Yorkshire Industrial Gas Centre, Ltd.,
Meadow Lane Gas-Works,
Leeds, 11.
Mar. 11, 1946.

Yours faithfully,
D. C. GUNN,
Engineer, Manager, and Secretary.

British Gas Council

A Meeting of the British Gas Council was held at Gas Industry House, 1, Grosvenor Place, London, S.W. 1, on March 12. Colonel H. C. Smith, C.B.E., D.L., J.P., Acting Chairman, presided, and there were 55 members present.

A report was made by the representatives of the British Gas Council at the Employer's Conference convened in London on March 7, 1946, by the Federation of British Industries and the British Employer's Confederation, to discuss with the Prime Minister and Ministers the problems facing the country in the immediate transitional period. The Prime Minister appealed for the fullest co-operation of employers in industry in the Government's drive for prosperity. The urgent necessity for maximum production was made clear by other Ministers of the Crown, and the particularly dangerous period which faced the country during the next two or three years was stressed. The President of the Federation of British Industries invited the Government to give attention to, *inter alia*, the removal of present unsettlement, which increasingly prejudiced the prospect of production. He added that, among the causes of unsettlement, was uncertainty about the Government's nationalization programme, which worried and distracted everybody and took attention from more urgent and vital things.

Nationalization of the Gas Industry

Further consideration was given to the proposed nationalization of the Gas Industry in general and the Heyworth Report in particular, and it was agreed:

(*a*) That a letter should be sent to the Ministry of Fuel and Power urging the postponement of any plans for the nationalization of the Gas Industry, which, in the meantime, should be encouraged—in co-operation with the Ministry—to develop on evolutionary lines, which necessitated the expedition of permission to proceed with schemes of development and an early decision as to the financing of such schemes, and—

(*b*) That the following statement relating to the foregoing should be released:

"While the British Gas Council has not supported and does not support nationalization as an economic principle applicable with advantage to its affairs, it intimated to the Minister of Fuel and Power that, if the Government proceeded with its intention to nationalize the Gas Industry, the British Gas Council was willing, in the interest of the maintenance and development of gas supply to the public, to discuss the detailed implementation of the Government's policy.

"In view, however, of the Prime Minister's appeal for the fullest co-operation of emplo yers in Industry in the Government's drive for prosperity, the British Gas Council draws attention to the fact that the Government's nationalization programme has created unsettlement in the Gas Industry. As in other Industries, it takes attention from more urgent and vital things.

"Consequently, the British Gas Council considers it its duty to urge most seriously that the Government should postpone any plans for the nationalization of the Gas Industry, for at least the particularly dangerous period which, Ministers of the Crown have stressed, faces the country during the next two or three years.

"In the meantime the Gas Industry should be encouraged, in co-operation with the Ministry of Fuel and Power, to develop on evolutionary lines, which necessitates the expedition of permission to proceed with schemes of development and an early decision as to the finance of such schemes."

Coal Industry Nationalization.—It was reported that amendments to the nationalization of the Coal Industry Bill tabled by the Conjoint Conference of Public Utility Associations had not been accepted by the Government.

Committee Reports.—Consideration was given to reports from the Executive Board, Domestic Development Committee, Gas Industry Oil Committee, Finance Committee and Staff Reorganization Committee.

World Power Conference.—Mr. J. R. W. Alexander was nominated to represent the Council on the British National Committee of the World Power Conference.

Victory Parade.—Report was made as to the tentative arrangements for the participation of the Gas Industry in the Victory Parade in London on June 8.

Exhibitions.—Attention was drawn to the arrangements made for the following exhibitions:

(*a*) "*Good Heating for every Home Exhibition*," organized by the Solid Smokeless Fuels Federation at the Royal Horticultural Hall, Vincent Square, London, from March 13 to 30.

(*b*) "*Home Planning Exhibition*," organized by the British Gas Council for district display, commencing in Manchester on April 10.

(*c*) "*Other People's Jobs Exhibition*," organized by the Ministry of Fuel and Power for district display, and to which a gas kitchen had been added by the British Gas Council.

(*d*) "*Modern Homes Exhibition*," organized by the *Daily Herald*, at Dorland Hall, Lower Regent Street, London, commencing on March 27, which would include a gas kitchen presented by the Women's Gas Council.

(*e*) "*Britain Can Make It Exhibition*," organized by the Council of Industrial Design at the Victoria and Albert Museum, South Kensington, London, commencing on Sept. 24, for which the British Gas Council and the Society of British Gas Industries would jointly submit appliances for selection for display.

Membership.—The following alteration in membership was reported: *Addition*—Mr. R. H. Duxbury (South Bank and Normanby) in place of Mr. A. E. Ruffhead (Darlington).

Dates of Meetings.—(*a*) It was noted that the next meeting of the Executive Board would be held on April 2, at 11.30 a.m., and of the Council on April 9, at 2.30 p.m. (*b*) The Council accepted the invitation of the President of the British Commercial Gas Association to hold the May Meeting of the British Gas Council in Leicester on May 14. (*c*) It was agreed that the Annual General Meetings of the National Gas Council and the British Commercial Gas Association should be held in London during the afternoon of Wednesday, June 5.

Diary

Mar. 21.—Midland Counties Coke Association: Eighth Annual General Meeting. King Edward House, 135, New Street, Birmingham, 2.30 p.m.

Mar. 22.—London and Southern District Junior Gas Association: Reception and Dance, Caxton Hall, Westminster.

Mar. 23.—London and Southern District Junior Gas Association: All-day conference at Gas Industry House, including six Technical Papers covering Education, Gas Manufacture, and Gas Utilization.

Mar. 26.—Institute of Fuel: Sound Film, "Steam," Royal Geographical Society Hall, 6 p.m.

Mar. 26.—Southern Association of Gas Engineers and Managers (Eastern District): "A New Method of Increasing Retort Tightness," A. Bird, London Manager of West's Gas Improvement Co., Ltd., Gas Industry House, 2.30 p.m.

Mar. 26.—Midland Junior Gas Association: Visit to Foleshill Works, Coventry Gas Department, 3.30 p.m. "Six Years of Production Problems, Investigations, and Results," A. E. West, 6.30 p.m.

Mar. 28.—Midland Association of Gas Engineers and Managers: Annual General Meeting, King Edward House, New Street, Birmingham, 2.30 p.m.

April 4.—Midland Junior Gas Association: "The Gas Industry in the Post-War World," J. K. Mitchell (Dudley).

April 6.—Scottish Junior Gas Association (Eastern District): Short Paper Day at Dunfermline.

April 10.—London and Southern District Junior Gas Association: Visit to Watson House.

April 10.—North-Western Fuel Luncheon Club: "Research in the Fuel Industry," Dr. E. V. Evans, Engineers' Club, Albert Square, Manchester, 12.30 for 12.45 p.m.

April 12.—Institution of Chemical Engineers: 24th Annual Corporate Meeting, Connaught Rooms, W.C. 2, 11 a.m.; Presidential Address, Hugh Griffiths, 12 noon; Luncheon, 1 p.m.

April 12.—North British Association of Gas Managers: Spring Meeting, Lesser Town Hall, Coatbridge, 10.30 a.m. Presidential Address, Mr. T. S. Lockhart, Rothesay.

Nationalization and the Gas Industry

We have already published ("JOURNAL" of March 6) several extracts from the speeches of Chairmen of Gas Companies on the question of the proposed nationalization of the Gas Industry. Here are further expressed opinions:

Mr. George H. Boucher, Chairman of the Bristol Gas Company: "The Gas Industry has not supported and does not support nationalization as an economic principle applicable with advantage to its affairs, but the electorate have returned to Parliament, with an overwhelming majority, a Government which is pledged to the nationalization of gas, among other industries. It cannot be assumed that any substituted Government would adopt a different policy towards the Gas Industry, especially having regard to the findings of the Heyworth Committee, which was set up by a Government composed of all political parties."

* * *

Mr. J. F. Cameron, Chairman of the Cambridge University and Town Gas Light Company:

"Turning to the proposed nationalization of the Gas Industry, I recall that the Heyworth Report recommended the compulsory purchase of all existing undertakings and the division of the country into ten regions, each under its own Board of Directors, who would be appointed by the Minister of Fuel and Power. As the Eastern area is now drawn, Cambridge is near the centre. From the coast line of Norfolk, Suffolk, and part of Essex the area stretched inland to include Spalding, Loughborough, Leicester, Buckingham, Luton and Chelmsford. There is yet no indication of how or when the Government will deal with the problem, whether they will adopt the Heyworth plan of regionalization or whether they will deal with the Industry as a single national unit. There have been conversations between representatives of the British Gas Council and the Ministry of Fuel and Power. The Industry cannot resist nationalization, which is now in the realm of politics, but it is to be hoped that further negotiations will give needful guidance to existing Boards of Directors for the conduct of their affairs in the period which will intervene before nationalization is effected. It is obviously necessary that everything should be done which is required to maintain efficiency and to allow for normal development, but when it comes to other major schemes which are under consideration and might involve large sums, I think it reasonable that before we commit ourselves we should inquire if such a scheme will be required under nationalization, and how the Company will be compensated if nationalization takes place before the scheme is remunerative—or even possibly before it is completed."

* * *

Sir **Henry K. Stephenson,** Chairman of the Sheffield and District Gas Company:

"We consider that no case has been made out for nationalizing the Gas Industry, and we do not forget that Mr. Herbert Morrison, Lord President of the Council, when addressing an American audience in Washington used the following words: 'We shall not nationalize out of any idea for the implementation of abstract socialist theory, but for the fact that the industries concerned must be reorganized and placed at the efficient service of the country.'

"The Gas Industry has a splendid record of efficient service to the community, especially during the war years, and by Mr. Morrison's test is not a fit subject for nationalization. Unless, therefore, Mr. Morrison speaks with one voice in America and another in this country, which I should be sorry to think, we should count him on our side.

"From all quarters of the country those responsible for carrying on the Gas Industry have protested, not against the principle of nationalization, but against the application of such a policy to an efficient and progressive industry without any proof of necessity or desirability. We can only hope that the Government will re-examine the matter in the light of the powerful arguments which have been adduced by those best qualified to know, and will give the Industry the opportunity to develop and expand on the lines suggested in the report of the British Gas Federation."

We turn to the decisions of municipally-owned undertakings.

After a vote Dunfermline Town Council has decided to support nationalization of gas undertakings. Last week Bailie Gellatly reported that he had attended a meeting of the Association of Local Authority Gas Undertakings in Scotland. There were proposals for and against nationalization before the meeting, but as a number of the representatives were attending without mandates the matter was remitted back. He wanted it to be quite clear to the Council that the mandate which the Dunfermline Committee conveyed was that they were supporting the Government policy on nationalization, with the reservation that the local authorities should be given an opportunity of expressing to the Ministry of Fuel their views on the form nationalization should take. Opposing the motion, Councillor Dick said he could not agree to nationalization. He felt that better service would be maintained under municipal control. Bailie Gellatly, replying, said the whole matter had been thoroughly discussed by the General Committee of the Local Authorities Association. They found that the consensus had been particularly among technicians of the Industry, who thought that nationalization would be to the ultimate benefit of the Industry as a whole.

Paisley Town Council has also approved the policy of nationalization on the indication that Glasgow, with the largest undertaking in Scotland, had approved the policy.

A Junior Convention

The London and Southern District Junior Gas Association, under the presidency of Mr. L. W. Andrew, are to hold on Saturday next a whole-day technical conference at Gas Industry House. The conference will be opened by the President of the Institution of Gas Engineers, and there are to be combined sessions and also individual ones dealing respectively with gas production and gas utilization. The meeting starts at 10 o'clock, and will be opened by Colonel C. M. Croft, and at 10.30 there will be a combined session, when B. W. Dawkins and R. N. LeFevre will open a discussion on education and training. At 11.45 a.m. the Gas Production Group will have a Paper by F. J. Dent and L. A. Moignard on "The Catalytic Synthesis of Methane for Gas Enrichment"; and at the same time the Gas Utilization Group will be discussing a Paper by J. E. Davis, of the South Metropolitan Gas Company, on "Gas Service and Gas Quality."

After luncheon, sessions will be divided between the two groups, the Gas Production Group being addressed by W. L. Boon on the "Preparation of Coke for the Domestic Market," the while the Gas Utilization Group will hear a Paper by T. V. Garrud and A. E. Tyrrell on "Industrial Gas in War and Peace." At 3.15 the meeting combines again to hear a Paper by Stirling Everard on "Load Factor and Gas Pricing."

After this heavy technical Saturday the members will join with the ladies for tea in the Women's Gas Council rooms, where previously the wives and friends of members of the Junior Association will have enjoyed a film show and a short talk.

On the evening prior to this conference there is to be a reception and dance at Caxton Hall, Westminster. The reception will be by Mr. and Mrs. Andrew and the four war-time presidents and their ladies.

Welded Gasholders

From the Oxley Engineering Co., Ltd., Leeds, we have received a new 16-page brochure describing and illustrating the salient features of the Oxley patented all-welded design of gasholder. The Oxley system has been developed gradually over the past 25 years, and, while it is claimed to be the best that can be obtained at present, the Company will continue its research in conjunction with the continued progress that may take place in the science, art, and application of electric welding.

The advantages of the all-welded design are fully discussed in relation to the tank, lifts, side sheeting, top curb, cups and dips, overflow and return ducts, rain-water pipes, and pressure release ducts, and a chapter is devoted to self-adjusting and self-lubricating roller carriages. Roller carriage tests are now being carried out on a machine in the Company's works specially designed to test carriages under conditions much more severe than could ever exist under actual working conditions.

With the welded design of tank and lifts an even surface is obtained, which considerably facilitates the painting, due to the fact that there are no crevices or projections such as rivet heads, where extreme care is necessary to ensure the efficient application of paint. The most common source of trouble on a riveted holder is that found to be due to corrosion on lap edges and around the rivet heads, but this trouble is entirely eliminated on the all-welded design.

Messrs. James Stott & Co. (Engineers), Ltd., of Vernon Works, Oldham, have opened London Showrooms at 27, St. George Street, Hanover Square, W. 1, 'phone Mayfair 1967/8. A representative display of the firm's catering equipment is on view.

The Annual General Meeting of the Midland Association of Gas Engineers and Managers will be held at King Edward House, New Street, Birmingham, on Mar. 28, at 2.30 p.m. Following routine business Mr. Geo. P. Mitchell, Managing Director and Chief Engineer of the Worcester New Gas Light Company, will be inducted as President and will deliver his Presidential Address.

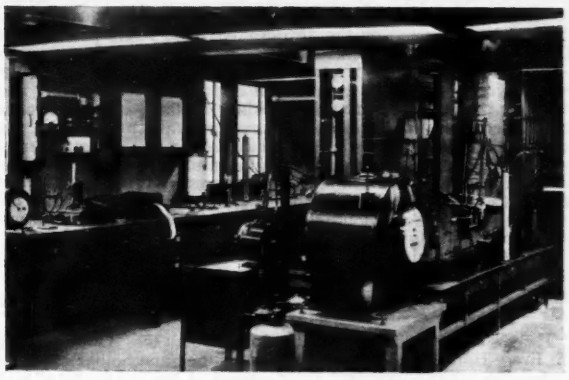
The Institution of Chemical Engineers will hold its 24th annual corporate meeting on April 12, at the Connaught Rooms, Great Queen Street, London, W.C. 2. The annual business, including the presentation of the Osborne Reynolds, Moulton, Junior Moulton, and William Macnab Medals, begins at 11 a.m., followed by Mr. Hugh Griffiths' Presidential Address at 12 noon, and the annual luncheon at 1 p.m.

Post-War Ascot Organization

WE were afforded the opportunity last week of inspecting the whole of the post-war Ascot organization. We toured the works at Neasden, described previously in the "JOURNAL," and saw what is being done in the research and development laboratories at Tolworth. We were impressed with the rapid strides which the firm has made in changing over from wartime work to peacetime production.

As is well known, during the war the Neasden works concentrated chiefly on the production of aircraft turrets under the Parnall aircraft organization, and we think it is a cause for congratulation that so much transition has been made in the course of a matter of months to manufacture in quantity once again Ascot water heaters of various types to help to meet the enormous demand for both home and export markets. Throughout the war every effort was put forward with the restricted raw material supplies available towards the production of spare parts for maintenance and repair work. At the same time the manufacture of complete appliances was undertaken for priority installations of national importance, and no fewer than 142,000 water heaters were produced in this period. In the latter months of 1945, 40,000 water heaters were made, a number which, we were told, could easily have been increased had it not been decided to sacrifice production of new appliances in favour of spare parts. In 1938 the Company obtained its maximum output. In 1946 the output will be increased by at least one-third in comparison with 1938. Increased production, while improving standards of manufacture, is the firm's aim, and a thorough reorganization has taken place covering the new building programmes, conversion of existing property, deferred demand, and replacement demand. All this, of course, apart from the export market.

The Physics Laboratory.



The Development Laboratory.

We have mentioned that during the war the Parnall group made a large contribution to armament production. This was chiefly in the field of aircraft turrets and scanners for radar, of which they were the largest producers in the country. Nash & Thompson, Ltd., were responsible for the design of these products, for which an organization covering an extremely wide field was built up. The high priority of this wartime programme prevented the utilization of technical staff on water-heater work until after the war. When Ministry clearance was given for post-war work, the Ascot research and development department could be built up from the Nash & Thompson wartime organization according to prepared plans. The adaptation of the department to its new task proved simpler than was expected, and made it clear that many aspects of the broad field covered by the organization in wartime had bearings on water-heater design. These laboratories, which are extensive, are, as we mentioned earlier, situated at Tolworth, and the present programme includes the continuation of some Radar development, but the concentration of personnel is on water heaters, and is being expanded as fast as possible. As was explained to us, the policy of the maximum possible production of water heaters involves concentrating the efforts of the design organization on the accurate specification and maintenance of the quality which already existed and the elimination of wartime expedients. This requires effort from the staff responsible for later stages of development; and as the most rapid means of ensuring quality, highest priority has been given to the application of precision testing to current production. This production commitment does not heavily involve the staff concerned with research, who have embarked on a large-scale programme which will provide a basis for new developments.

Multi-point and bath heater assembly lines.

Final assembly and test.

We were struck with the way in which all the work is co-ordinated, and with the firm's plans for expansion and incorporation of new methods. At Neasden the main functional departments are purchasing, works engineers, production, inspection, and personnel; and the facilities offered to employees embrace a model canteen, first aid including hospital treatment, welfare, and the innumerable activities of a sports and social club. The factory itself is at the moment passing through the final transitional changes of the complete change-over to peacetime production, though considerable work remains to be done in modernizing the plant to satisfy the increased demand anticipated by the firm.

The research laboratories constitute part of the Ascot post-war plan to build and equip laboratories which are intended to take their place in the front rank of industrial laboratories. This cannot be done immediately, and the research and development department is "making do" with wartime temporary buildings. These comprise eight bays 120 ft. long and 20 ft. wide joined by a central block and cover an area of 20,000 sq.ft.; they house a present establishment of 140, and contain a generous supply of high-class experimental plant and laboratory apparatus. The technical programme is directed by the Chief Engineer, Mr. A. Whitaker, and is implemented by the Deputy Chief Engineer, Mr. N. Barnes, who correlates the work of

the six main technical divisions of the Department, which are as follows: Physics, Chemistry and Metallurgy, Process Research, Development Engineering, Drawing Office, Test Gear and Testing. In addition to this an Administration division arranges all the non-technical and routine work, and there are subsidiary sections, such as workshop, library, print room, photographic room, stores, &c.

The operation of the technical divisions can be explained by tracing the course of a new job, assuming that the Department is operating normally. The first two divisions quoted, concerned with research in their respective fields, provide fundamental data relative to the project to be developed. Process Research division provides information on the latest technique available which has to be embodied in the design from the start. On this basis the Development Engineers commence work on a specific model, which passes through several stages from an initial "rough" to a final prototype, thoroughly tested in the laboratory and on the district. As these stages proceed, the Drawing Office takes an increasing interest until, coincident with a proved prototype, a set of production drawings is ready, while the necessary action is taken by the Test division to cover testing and test gear. After issue of these drawings to the works, contact is maintained until production is running smoothly. In parallel, the organization must deal with all technical action required on current models, for which purpose queries are fed into the respective divisions as required. We were told that at the present time an abnormal load of this type is imposed on the department.

All this activity is obviously in the interests of the Gas Industry.

Smokeless Fuels Exhibition

There is a heartening pre-war atmosphere about the " Good Heating for Every Home " exhibition presented by the Solid Smokeless Fuels Federation. The exhibition, which opened at the Horticultural Hall on March 13, is probably the largest of its kind since the war, and no pains have been spared to make it a success. It is remarkable therefore that the keynote throughout is economy. The coal shortage has turned the industry's thoughts more than ever to the conservation of fuel supplies, and this exhibition takes every opportunity of pressing its message home. Efficiency breeds economy. Old appliances and old methods spell wastage of vital fuel.

At a luncheon to celebrate the opening of the exhibition, Alderman W. Key, M.P., Parliamentary Secretary to the Ministry of Health, emphasized that every aspect of living in a house depends upon the arrangements for cooking meals. In the past local authorities had planned for most people by providing a coal fire in the living-room for cooking and water heating. Therefore meals were cooked and eaten in the same room. The scullery was designed to discourage its use for anything other than cooking, washing-up, and laundry. Between the wars, however, changes had taken place. The need for a circulating hot-water supply and background heating was gradually appreciated. New houses had either living kitchens, working kitchens, or dining kitchens. The working kitchen was more appropriate for gas or electricity, but any form of fuel might be used in the dining kitchen. It was a definite criticism of our community that in cold weather the British working man's home was the smallest in the civilized world. Only one part of the house was usable—that near the hearth-rug. The rest was unwarmed. The effect of efficient heating was to induce increased family activity, and provide privacy for work and a larger field for play for the children. There has been at the same time an increased appreciation of outside amenities. This was particularly so with regard to the prevention of unnecessary smoke. The Ministry approved of any appliance discouraging smoke, and was warmly in favour of the efforts made by manufacturers towards this end. The general public must be educated to appreciate the advantages of unpolluted air, and their enthusiasm must be aroused by every possible means. Reviewing the progress made by manufacturers, the time had come for the Government to take a clearer lead. At present they were hampered by emergency programmes, the urgent need for efficient appliances at a minimum cost, and coal shortage difficulties. The latter formed an additional urge to make more efficient use of coal. He envisaged a revolution in life with greatly improved amenities. This exhibition was a step towards that goal, and he warmly welcomed it.

The Rt. Hon. Lord Hyndley, C.B.E., (Chairman of the National Coal Board), said that this was a time of opportunity. Co-operation was necessary for all concerned, and he wished the Federation and their exhibition every success. He hoped the offices of the Coal Board had been warm; some of the Ministries had suffered severely from cold.

A Fine Display

Every effort has been made to make the exhibition attractive, and the hall and stands are handsomely decorated in pale blue and yellow. The main wall carries a panorama showing the products of the carbonization of coal. This includes not only a huge painted backboard, but incorporates models, diagrams, and many tiny sections each devoted to one particular derivative. Another wall is painted to represent the smoke pall which overhangs a city and is, of course, produced by the National Smoke Abatement Society. The diagrams to be seen on this stand are particularly interesting, showing as they do methods employed for the complete abolition of smoke pollution by means of gradually expanding smokeless zones. Photographs and examples of stonework clearly show the damaging erosive effects of city smoke. A third stand displays many types of fuel produced by members of the Federation. The examples of South Wales anthracite, gas coke, hard coke, carbonized ovoids, &c., must cause some envy in the eyes of those unfortunates unable to obtain fuel for their homes. H.M. Stationery Office is represented, and the Information Bureau is well-stocked with literature on heating and ventilating problems.

The stands occupying the centre of the hall are divided roughly into five sections, dealing with space heating, hot water supply, central heating, cookers, combination and back-to-back grates respectively. Every appliance shown receives individual treatment, being incorporated in a separate tableau painted to represent a room. Credit must here be given to Mr. Ian Jeffcott, who was responsible for the designs.

Improved Appliances

The space-heating section has examples of convector open fires, heating stoves, back boilers and radiators. Remarkable progress has been made in the finish of these appliances, which are in many colours and look most attractive in a room. A group which caused some comment consisted of a heating cabinet manufactured by Weatherfoil Heating Systems and used—in this case—in conjunction with a Janitor magazine type boiler. Warm air is radiated from the cabinet by a fan regulated by a house thermostat.

There are a large number of hot water boilers to be seen, many having considerable improvements over the earlier models. This is particularly noticeable in the case of damper control and the increased facilities for overnight burning. Improvements are obvious too in the case of cookers, and many such as those manufactured by Radiation Ltd. and Allied Ironfounders, Ltd., are most pleasing in appearance. Many types are on show, ranging from the open fire combination grate with side oven to the totally enclosed heat storage unit. In some of the models provision is made for the inclusion of gas burners for summer use.

Other items of interest include the Heat Service Units now in use on Government building sites, methods of fuel storage, and a considerable range of accessories, including Edgar gas pokers. There are several designs of thermostat, and a working diagram showing thermostatic control of combined systems of heating and hot water services is a feature of the Drayton Regulator and Instrument Company stand.

There is always a certain fascination and satisfaction to be found in seeing things work, and it is therefore not surprising that one of the most popular exhibits is that of the Fuel Research Station, where visitors can watch the measurement of the air pollution of the hall. The part played by the Gas Industry in the field of research is amply shown by the range of testing apparatus to be seen upon the stand of the Gas Light and Coke Company and the South Metropolitan Gas Company. Here the Fulham grate is put through its paces.

Variety in Economy

An aspect of heat economy much neglected in the past is the retention of the heat within the house by insulation. The exhibit demonstrating the advantages of improved house construction is a source of great interest to visitors. Examples of wall and roof construction using foam slag, wood wool slabs, concrete panels, aluminium foil, and other materials are to be seen. Heat retention is demonstrated by a working example consisting of two model houses, one equipped with Alfol foil on ceiling joists and forming a diaphragm in the hollow walls and under the floor.

We have said the slogan of the exhibition is economy. A series of leaflets and pamphlets entitled " How to Stop Waste Fuel " is available which gives clear, concise, and most useful advice on the operation of central heating boilers, domestic hot-water boilers, small steam-raising plants, &c. These pamphlets draw attention to possible fuel and heat wastage by such causes as deposit on fire-pot walls, air leakage due to poorly fitting doors, and inaccurate use of dampers.

The exhibition is notable for its planning as a whole and the imagination which went into its production.

Plans for the Extension of the area of supply of the Stafford Gas Department were disclosed by Mr. T. H. Poulson, Engineer and Manager, when lecturing at Stafford last week. The present authorized area of supply was 84 square miles. Additional powers were now being sought for authorization of further substantial areas of supply and the use of additional lands for manufacture and storage of gas. Villages in the area would be supplied with gas from Stafford by means of a high-pressure system which would be governed down for private and industrial use. The development of high-pressure gas mains would be part of a general scheme for increasing the gas supply of Stafford and district. Though it would not be possible to retain gas prices at their present low level, the necessary increases would be slight. Geographically Stafford was well able to supply areas up to 10 or 12 miles distant.

Removal of Sulphur Compounds from Town Gas by Catalytic Hydrogenation

By E. B. MAXTED, D.Sc., and J. J. PRIESTLEY, M.Sc. (W. C. Holmes & Co., Ltd.)

THE removal of the organic sulphur compounds from towns gas is regarded at the present time as not only desirable but essential. The harm caused by sulphur was recognized at an early date by the legislators who framed the restrictions placed on the hydrogen sulphide contents of the towns gas. Attempts were made to restrict the organic sulphur content of the gas in the case of certain London gas companies by imposing restricting clauses in the Gas Acts of those companies. The only practicable method then available was lime purification, and, apart from the cost and the indifferent results obtained, a serious nuisance was created at the works. For these reasons, after considerable agitation by the companies concerned, the clauses were removed.

In more recent times there has been a return to the view that the organic sulphur compounds must be removed; for instance, sulphur removal to less than 10 grains/100 cu.ft. is one of the recommendations of the Heyworth Committee's Report on the Gas Industry.

In 1937 oil-washing processes for CS_2 removal and benzole recovery were developed, under patents taken out by The Gas Light and Coke Company, and W. C. Holmes & Co., Ltd. ("GAS JOURNAL," July 28, 1937). More recently attention has been given to catalytic processes.

In this account we propose to describe work carried out on the technical problem of reducing the organic sulphur compounds in gas to such a degree that it can be regarded as a sulphur-free fuel for all practical purposes. It concerns the development of a particular field of catalytic hydrogenation, a process already well established in the chemical and petroleum industries, namely its application to the conversion and removal of the organic sulphur compounds in towns gas. This work, which was begun in 1937, is described in three sections as follows:

(1) Fundamental experimental work.
(2) The full-scale experimental catalytic sulphur removal plant at the works of the Mirfield Gas Company.
(3) The removal of sulphur compounds at the Works of the specialized consumer.

The authors are indebted to the Directors of Messrs. W. C. Holmes & Co., Ltd., for permission to publish the results, and to the Directors of the Mirfield Gas Company, particularly Mr. Norman Hudson, Engineer, Managing Director and Secretary, for the extensive facilities granted at their works, and for co-operation in the progress of the research.

Their special thanks are due to Mr. J. E. Holliday, Engineer, Manager, and Secretary of the Otley Gas Company (United Kingdom Gas Corporation), and Mr. Paul Guest, Director, Messrs. Thomas Webb & Corbett, Ltd. Finally, the success of this work has been due in no small way to the unstinted efforts of fellow members of the Technical Staff of Messrs. W. C. Holmes & Co., Ltd., to whom the authors wish to give grateful acknowledgment.

Fundamental Experimental Work

The practical removal of organic sulphur compounds from towns gas by their destructive hydrogenation to suphuretted hydrogen at high or moderate temperatures may be regarded as beginning with the work of Carpenter and Evans (*Journal of Gas Lighting*, 1914, **126**, 928) during the period 1906 to 1914. The contact body used in the Carpenter-Evans process consisted of a porous fireclay support impregnated with nickel chloride, which was subsequently reduced to the metal and exposed to the sulphur-containing gas; and these workers (*J. Soc. Chem. Ind.*, 1915, **34**, 9) regarded the catalyst as then consisting of a mixture of metallic nickel with a small quantity of nickel sulphide, the amount of the latter being, at any temperature, a function of the relative proportion of H_2S and hydrogen in the gas at the surface of the catalyst. An interesting and important improvement in the use of catalysts of the nickel or nickel sulphide type has resulted from the work of R. H. Griffith and the Gas Light and Coke Company (Brit. Pat. No. 489,398/37, and *Trans. Inst. Gas E.*, 1937/38, **87**, 331) on the use of nickel sub-sulphide (prepared by reducing a ceramic support impregnated with nickel sulphate) under oxidizing in place of under reducing conditions, whereby the sulphur arising from the decomposition of the organic sulphur compounds is obtained in the form of sulphur dioxide in place of H_2S.

It is obvious that contact substances for the splitting-off of sulphur, as H_2S, from the organic sulphur compounds in coal gas must be catalysts which are tolerant to sulphur. In view of the activity of sulphides of the molybdenum sulphide type as hydrogenation and dehydrogenation catalysts in somewhat analogous reactions, such as the hydrogenation-cracking of hydrocarbons and the elimination of oxygen from phenols, it was of interest to investigate the use, for coal gas desulphurization, of catalysts which contain in one and the same molecule, molybdenum, a suitable second metal, not necessarily of the transition group, and sulphur. This class of catalyst is represented by the metallic thiomolybdates, which were found to be highly effective contact bodies for the purpose required.

Normal thiomolybdates have a composition corresponding, in the case for instance of a bivalent metal, M, with a formula $MMoS_4$; but, even if introduced as a normal thiomolybdate, such molecules, at high temperatures and in the presence of gaseous sulphur compounds and of the other constituents of coal gas, are probably subjected to a sulphur balance in which the momentary sulphur content of the catalyst is a function of the temperature and of the sulphur content of the gas treated.

The capacity for a kinetic sulphur balance probably constitutes an important factor in determining their catalytic activity; and, since the equilibrium sulphur content at the catalytic surface cannot be formulated by ordinary chemical formulae, the term metallic thiomolybdate is to be understood to include not only the normal salts, but also other compounds containing a metal, molybdenum and sulphur in one and the same molecule, and particularly the equilibrium phase of this nature formed by virtue of the sulphur balance.

Small-scale work on the removal of organic sulphur compounds from purified, crude and partially crude gas is described. The behaviour of various metallic thiomolybdates is described, and a study made of various factors influencing the degree of sulphur removal. The destructive hydrogenation of individual sulphur compounds is described. The section concludes with a discussion of carbon formation during hydrogenation, and methods of catalyst preparation.

The present process, based on British Patent No. 490,775 (1937), involves the destructive hydrogenation of the various organic sulphur compounds, by the passage of the gas through various metallic thiomolybdates, the sulphur compounds being converted into hydrogen sulphide, which, unlike the original substances, can be absorbed in purifiers of the ordinary type.

The main experimental work was carried out at the works of the Otley Gas Company, beginning in July, 1938. Otley gas was made in continuous vertical retorts, and not stripped of benzole. This enabled work to be carried out on gas, purified, and crude, under actual gas-works conditions. The work done here falls roughly into

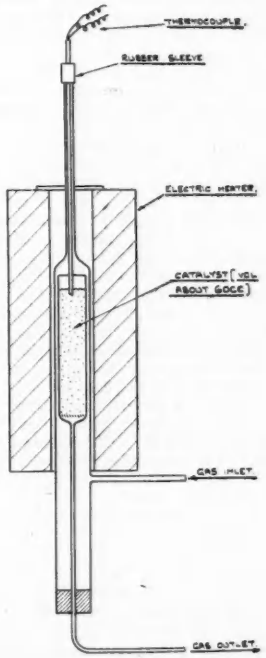


FIG. 1.—*Pyrex Converter.*

three classes, namely: (*a*) on purified gas, (*b*) on crude gas, (*c*) on gas which may be termed partially crude—*i.e.*, containing 50 to 200 grains of H_2S per 100 cu.ft.

Treatment of Purified Gas

Tests were carried out by passing gas through catalyst contained in an apparatus shown in fig. 1. About 60 c.c. cobalt thiomolybdate catalyst mounted on granular bauxite were maintained at the requisite temperature in a pyrex converter, surrounded by an electric heater, as shown. After passage through the catalyst, the treated gas was passed through a tower containing iron oxide or copper phosphate to remove H_2S, and the residual sulphur compounds determined in the usual way, by combustion of the gas and absorption of the SO_2 in hydrogen peroxide. Early tests were carried out at a S/V (space velocity—*i.e.*, volumes of gas per unit volume of catalyst space per hour) of 730 and a temperature of 450–480°C.

Later it was found that considerably increased space velocities and lower catalyst temperatures could be used. The tests on various thiomolybdates collected together in Table II were not all done simultaneously, which accounts for differences in space velocities used. The tests were carried on for as long as possible to determine the useful working life of the catalyst between regenerations.

In the cobalt thiomolybdate run, a duplicate converter was run at the same time, the only difference from the first being that the catalyst was mixed with steel turnings to detect, if any, the influence on the sulphur results. This was done as it was realized large plants would be made of steel. No detectable difference in the results obtained was noted.

TABLE I.—Various Thiomolybdates on Purified Gas (Otley). Catalysts Supported on Bauxite 10–20 Mesh.

(*Sulphur figures in grains/100 cu.ft. Average sulphur compounds in inlet gas—25 grains.*)

Days' run.	Cobalt. Temp. (°C.).	Cobalt. S/V.	Cobalt. Outlet sulphur compounds.	Zinc. Temp. (°C.).	Zinc. S/V.	Zinc. Outlet sulphur compounds.	Iron. Temp. (°C.).	Iron. S/V.	Iron. Outlet sulphur compounds.
1	400	470	3.7	400	1,250	3.7	400	1,250	...
2	400	470	3.5	400	1,250	3.8	400	1,250	2.8
7	400	470	4.1	400	1,250	4.6	400	1,500	3.3
13	400	470	3.3	410	1,000	6.3	405	1,000	4.9
21	400	470	4.3	400	2,000	5.7	375	2,000	5.2
32	400	470	5.2	410	1,500	4.8	400	1,500	4.0
42	400	940	4.3	400	1,500	5.5	400	1,500	5.5
51	400	940	...	410	1,500	5.7	400	1,500	5.4
56	450	940	5.0	410	1,500	4.8	415	1,500	4.6
64	450	1,880	4.4	...	...	...	...	...	...
67	450	2,820	4.0	...	...	...	...	...	...
71	450	2,820	5.0	...	...	...	...	...	...

Further satisfactory tests were obtained with the thiomolybdates of copper, tin, nickel, and manganese.

Space Velocities

Tests were carried out to find the limit of space velocity practicable with catalyst working on purified gas. The space velocity (S/V) was stepped up in a period of 14 days from 3,800 to 7,600. The sulphur compounds in the treated gas remained at 4 to 5 grains/100 cu.ft. up to a S/V of 5,700 and thereafter increased to 6.6 grains. The gas rate on a second series of experiments was still further increased, giving a S/V of 10,000 and 20,000. After 16 days' continuous operation at 10,000 S/V on Cu, Sn, Zn, and Co catalysts the average outlet sulphur content was 8.0 grains throughout. After 10 days' continuous operation at 20,000 S/V, Cu, Sn, Zn, and Co catalyst "fell off" in performance, but up to the 10th day had been giving average figures of 9.0 grains throughout. It was noted in all the high S/V tests that the catalyst became covered with carbon, and therefore lost efficiency in a shorter time than when lower rates were used. Roughly speaking, at any given temperature, the falling-off of the catalyst occurred after the passage of a given volume of gas, which at Otley was about 5,000,000 × the volume of the catalyst. For small scale work a S/V of 5,000 was decided upon as being a practicable maximum figure.

Two experimental series of attacks on individual sulphur compounds may be quoted, in which the methods used were different.

The first study was made by preparing a substantially sulphur-free gas stream, and adding each sulphur compound in turn and observing the conversion when passed through the catalyst. Both hydrogen and coal gas were used as carrier gases. Hydrogen presented no difficulties, but the coal gas had to be stripped first of its inherent sulphur compounds. This was done by passing it through a bed of catalyst, which incidentally removed all the oxygen as well, prior to addition of the particular sulphur compound undergoing test. Sulphur tests were done before and after conversion. Results obtained were as follows:

Tests in Hydrogen.

Catalyst: Cobalt thiomolybdate on bauxite.
Temperature: 450–490°C.

Sulphur compound.	Concentration in gas stream.	% conversion to H_2S.
Carbon disulphide	15 grains/100 cu.ft.	76.6%
Thiophene	25 grains/100 ,,	38.3%

Tests in Coal Gas (Mirfield).

Catalyst: Nickel thiomolybdate on bauxite.

Sulphur compound.	Temperature of catalyst.	% conversion to H_2S.
Carbon disulphide	350°C.	94.0%
Thiophene	(*a*) 350°C.	10.6%
	(*b*) 450°C.	9.4%
Ethyl mercaptan	350/370°C.	47.0%

The second study was made by carrying out an analysis of sulphur compounds in towns gas entering and leaving a small converter. The analytical method used was that described by Hollings, Hutchison and Griffith (*Trans. Inst. Gas E.*, 1937/38, p. 323).

Sulphur Compounds Removal (Huddersfield Town Gas).

Catalyst: Cobalt thiomolybdate on bauxite.
Temperature: 400°C.

Sulphur compounds.	Inlet gas.	Outlet gas.	% conversion.
Mercaptans	1.0	Trace	Nearly 100%
Thiophene	2.2	2.0	9.1%
Carbon disulphide	18.7	Trace	Nearly 100%
Carbon oxysulphide	7.9	1.4	82.3%
Total	29.8	3.4	88.6%

Effect of Temperature.

Generally speaking a temperature of 340°C. minimum was required for successful catalyst operation, as below this temperature conversion was incomplete. This is shown in the graph, fig. 2, for zinc thiomolybdate, but is typical of all the metallic thiomolybdates studied.

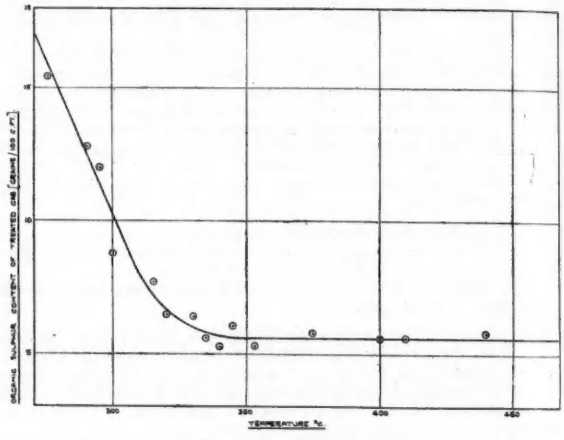


FIG. 2.—*Effect of temperature on organic sulphur removal from purified gas. Catalyst—Zinc thiomolybdate on bauxite. S/V = 1,000.*

Treatment of Crude Gas

Ability to desulphurize crude gas has the attractive feature of not requiring extra purifiers or catch boxes to remove H_2S formed during hydrogenation. It was found that on treating a crude gas containing up to 600 grains of H_2S per 100 cu.ft., higher figures for sulphur compounds leaving unconverted were obtained than with purified gas. The following table shows a typical set of results and one on purified gas for comparison.

Catalyst on Crude and Purified Gas (Otley).

Catalyst: Zinc thiomolybdate on bauxite.
Temperature: 400°C.
Average sulphur compounds at inlet: 24–25 grains/100 cu.ft.

Days' run.	Sulphur compounds in treated gas. On purified gas.	Sulphur compounds in treated gas. On crude gas (600 grains H_2S per 100 cu.ft.).
1	3.7 grains/100 cu.ft.	7.7 grains/100 cu.ft.
5	4.2 grains/100 ,,	10.1 grains/100 ,,
10	4.5 grains/100 ,,	8.8 grains/100 ,,
15	4.4 grains/100 ,,	9.3 grains/100 ,,
20	4.6 grains/100 ,,	11.6 grains/100 ,,

Long tests were carried out in which up to 50% of the gas volume of steam was added to the crude gas prior to catalyst treatment, hoping thereby to depress COS formation. Working on S/Vs of 1,880 to 3,760 with cobalt thiomolybdate at 400°C., the exit sulphur compounds were the same whether steam was used or not. Some synthesis of COS was obtained at 450°C. in the presence of steam.

The presence of up to 700 grains of ammonia per 100 cu.ft. was found to have no detectable influence on the conversion of sulphur compounds at 400°C.

Interesting figures were obtained with synthetic crude gas mixtures,

made from hydrogen, calor gas, carbon monoxide and hydrogen sulphide. Care was taken to exclude oxygen. Results are as follows:

Synthetic Gas Experiments.

Catalyst: Cobalt thiomolybdate on bauxite.
Temperature: = 400°C. S/V = 2,500 and 700.

Composition of synthetic gas. H_2 (%)	Calor gas. (%)	CO. (%)	H_2S addition.	Sulphur compounds in exit gas (grains/100 cu.ft.).
90	10	*Nil*	465 grains/100 cu.ft.	3.0
84.2	9.5	6.3	430 grains/100 ,,	4.9
77.2	8.5	14.3	365 grains/100 ,,	9.0
Nil	40.0	60.0	(400 grains/100 ,,)	71.0
Nil	*Nil*	100.0	420 grains/100 ,,	244.0

Considering the last of the above tests, analysis of the final sulphur compounds figure of 244 grains showed that 93% was COS, indicating synthesis from CO and H_2S. It will be noted that only about half the H_2S appears as COS. The other half was not unconverted H_2S, as less than 20 grains H_2S were detected in the exit gas. It is suggested that sulphur was absorbed by the catalyst during the experiment, as when the H_2S was shut off from the CO stream, the COS in the exit gas did not suddenly cease, but tailed off from 30.6 grains after 30 minutes to 12.7 after 105 minutes.

In general a temperature of 400°C. was found to be the best of the three stages tried (350°C., 400°C., 500°C.). Higher sulphur figures were obtained at 350°C. than at 400°C.; at 500°C. slightly lower, but the rate of carbon formation was excessive at the latter temperature. With regard to attack on individual sulphur compounds the following data were collected.

At 400°C. there is no marked attack on thiophene and mercaptans, CS_2 is reduced to 20% of its original value, and COS is almost unchanged. At 350°C. there appears to be an actual increase of the mercaptan content, the thiophene and COS remaining unchanged, the CS_2 being reduced to less than 20% of its original value. At 500°C. mercaptans and thiophene show little change from their original value, CS_2 is reduced to about 20% (as at 400°C.), and the COS shows a slight reduction.

Influence of Hydrogen Sulphide

Experiments indicated that there existed a fairly simple relationship between the hydrogen sulphide content of the gas and the sulphur compounds remaining unconverted in the treated gas. This was found to be approximately linear, though the graph of the results (fig. 3) shows that other factors influence the result, factors which

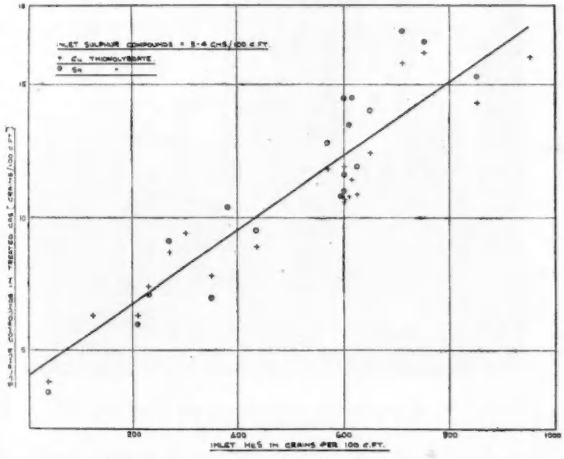


FIG. 3.—*Relationship between sulphur compounds and H_2S. Catalyst—Thiomolybdates on bauxite support. S/V = 1,000. Temperature 400°C.*

were not controlled under the conditions of the experiments. In these experiments gas was passed through a preliminary converter which reduced the sulphur compounds to 3 to 4 grains per 100 cu.ft. and removed the variable of oxygen altogether. Hydrogen sulphide was then admitted to the gas stream in varying quantities prior to passing the gas through the main converter. Sulphur compounds tests were carried out on the treated gas, at the converter outlet. Results for copper and tin thiomolybdates at 400°C. and S/V 1,000 are shown. They indicate that quite good sulphur removal can be obtained, with up to, say, 200 grains of H_2S per 100 cu.ft. Variations from the straight line relationship are no doubt due to changes in gas composition, notably CO, CO_2, and unsaturated hydrocarbons, as the tests were on make gas and extended over a period of about four weeks.

Various Thiomolybdates on Partially Crude Gas

The next stage was to carry out extended tests to study the behaviour of the catalyst on partially crude gas. Four were selected, copper, tin, zinc and cobalt thiomolybdates. These were put to work on gas which had had no catalytic pretreatment, but was merely purified make gas with an addition of H_2S in the desired quantity. Therefore they could be considered as operating under gas-works conditions in which the bulk of the H_2S had been removed, the remaining H_2S, together with that produced by hydrogenation in the converter being removed afterwards by final purification.

The results are graphed (figs. 4, 5, and 6). The four catalysts were tried successively on gas containing, per 100 cu.ft.: (*a*) 50/100 grains H_2S, (*b*) 100/150 grains H_2S, and (*c*) 150/200 grains H_2S.

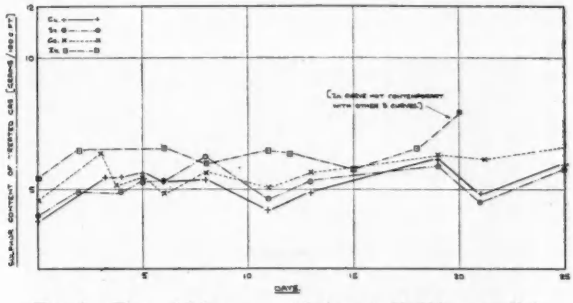


FIG. 4.—*Thiomolybdates on purified gas + 50–100 grains H_2S per 100 cu.ft. S/V = 5,000. Temperature 400°C.*

Broadly speaking all the results show daily variations usual with prolonged tests. Those with a 50-grain H_2S gas are little different from those obtained with purified gas, except that the zinc catalyst unaccountably fell off after 21 days. With the higher H_2S content of 100/150 grains, an average outlet sulphur content of about 7.0 grains was obtained on all catalysts over a period of 25 days. With 150/200 grains H_2S gas an average of 8.0 grains sulphur compounds was obtained. All graphs show the usual slow rise of sulphur compounds with time.

Carbon Formation during Catalysis

Formation of carbon takes place not only on the surface of the catalyst grains but in the pores as well. It is produced by the destructive hydrogenation of sulphur compounds, and probably from hydrocarbon degradation. The accumulation of carbon would seem to be directly proportional to the volume of gas passed, other things being equal. It is accelerated by increase of catalyst temperature, thereby shortening the effective life of the catalyst between regenerations.

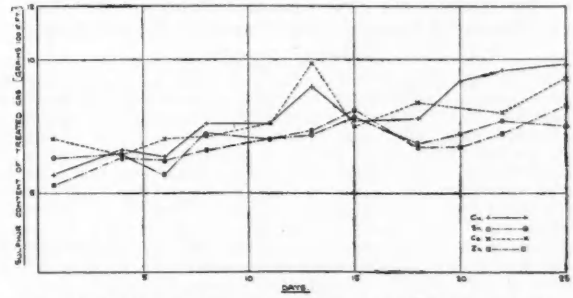


FIG. 5.—*Thiomolybdates on purified gas + 100–150 grains H_2S per 100 cu.ft. S/V = 5,000. Temperature 400°C.*

The "strength" of the catalyst—*i.e.*, the weight of active catalytic material in unit volume of support—was found to affect the rate of carbon formation, the "strongest" catalyst giving the smallest carbon deposition. Copper thiomolybdate catalysts of different "strength" were allowed to treat 900,000 volumes of gas each, at a S/V of 2,500 at 375°C. The carbon accumulation on each was determined by analysis, the results being as follows:

Wt. molybdenum/ litre catalyst.	% carbon.
146.5 gm.	2.05
73.3 ,,	3.00
36.6 ,,	4.33

Provided the temperature is maintained constant, up to 2% oxygen has little effect on carbon formation.

Catalyst Preparation

The preparation of catalysts was simplified considerably by the discovery that some metallic thiomolybdates could be prepared from the corresponding molybdates by submitting them to a current of H_2S at 350/400°C. Previously, H_2S was passed into a solution of ammonium molybdate to form ammonium thiomolybdate, which was evaporated on to the granular bauxite support followed by application of the metallic salt solution—*e.g.*, copper sulphate, and a second evaporation. The change in procedure meant that sulphur was introduced into the metallic molybdate instead of ammonium molybdate, which on a large scale was much simpler to carry out. Both reactions are strongly exothermic.

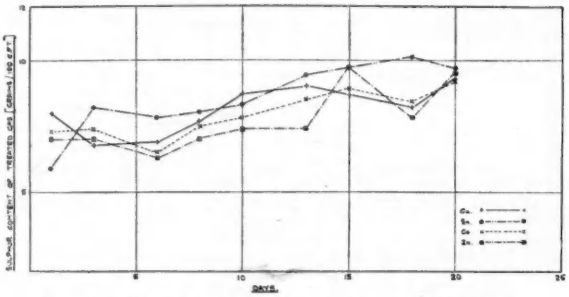


FIG. 6.—*Thiomolybdates on purified gas + 150–200 grains H_2S per 100 cu.ft. $S/V = 5{,}000$. Temperature 400°C.*

A further improvement was made by substituting first crude coal gas and finally purified gas containing sulphur compounds for hydrogen sulphide. It was found that sulphur was absorbed by the catalyst until a definite concentration was reached, this being accompanied by a change in colour of the catalyst. Tests on molybdates show that their efficiency for removal of sulphur compounds is poor, but as sulphur is absorbed and the change from molybdate to thiomolybdate takes place, this efficiency is increased until a stable figure is reached, this coinciding with the cessation of sulphur absorption by the catalyst itself. Some thiomolybdates—*e.g.*, zinc thiomolybdate—cannot be prepared in this way.

The molybdates are insoluble solids, and early practice of manufacture was to precipitate a molybdate by double decomposition in the pores of the support as described above. Recently it has been found that some molybdates—*e.g.*, cobalt, nickel, and copper—are soluble in a slight excess of ammonia. This simplifies catalyst preparation still further by making it possible to apply the molybdate in a single operation in the pores of the support, and, moreover, ensures there is not an accidental slight excess of the metal on the one hand, or molybdenum on the other, such as might occur in large-scale preparation with the double solution method.

The Full Scale Experimental Catalytic Sulphur Removal Plant at the Works of the Mirfield Gas Company

In 1943 the decision was made to construct a full-scale catalytic sulphur removal plant at a gas-works in order to study the problems associated with increase of the size of plant, and the variation of conditions under which such a plant would normally have to operate. It was considered better policy to construct a plant capable of handling the whole of the make from a small-sized works rather than a portion of the make from a large works, and that a gas throughput of ¼ million cu.ft. of gas per day represented the minimum size which would approximate to full-scale operation. With these considerations in mind, arrangements were made with the Directors of the Mirfield Gas Company to install an experimental catalytic sulphur removal plant at their works at Ravensthorpe, Dewsbury.

The total make of the Mirfield Gas Company's works is 150 million cu.ft. per annum (1945), consisting of approximately 66% of horizontal retort gas and the rest crude coke oven gas from Messrs. Inghams' Thornhill Collieries, Ltd. Crude coke oven gas is received into a holder at the Gas-Works, from which it is drawn in to the exhauster inlet and passed through the wet and dry purification systems along with the horizontal retort gas. Owing to the operation of the coke ovens, under war-time conditions, deliveries of gas were not uniform through the 24 hours, though the relief holder assisted in smoothing out this variation at the exhauster inlet. Consequently the throughput was liable to vary between 28,000 and 8,000 cu.ft. of gas per hour.

Finally there is at Mirfield a desulphurizing plant installed in 1934 by W. C. Holmes & Co., Ltd., for the removal of both CS_2 and benzole by oil washing. Throughout the period of our experiments with the catalytic sulphur removal plant, this was still run on the lines of a standard benzole recovery plant.

The experimental plant has been in operation for the major part of a year, and has handled 96,700,000 cu.ft. of mixed horizontal and coke oven gas in 225 days, reducing the sulphur compounds from about 28 grains to 10 grains per 100 cu.ft., which, after the gas had passed through the benzole plant, gave a district gas having a sulphur compound content of 3 to 6 grains per 100 cu.ft.

It has been shown that the plant is automatic in operation, requiring no shift attendants, and is capable of handling wide variations in oxygen content and in gas throughput, without any adjustment. No addition of oxygen other than that normally required for the iron oxide purifiers is made to the gas, and no attempt made to adjust it, for the operation of the C.S.R. plant.

The plant is economical in operation. The present overall cost of desulphurizing (excluding the benzole plant) is 0.239d. per therm, or 1.17d. per 1,000 cu.ft.

With the existing scale for evaluating crude benzole, a higher price can be obtained for benzole from a plant handling desulphurized gas, because of its lower sulphur content.

Mechanical arrangements on the plant all proved satisfactory. It is possible to discharge and charge catalyst without interfering with the operation of the plant.

With certain minor improvements the Mirfield design is considered suitable as the basis for designing larger units.

Successful methods of large-scale catalyst manufacture and regeneration have been worked out.

Description of Plant

It was decided to place the CSR (catalytic sulphur removal) plant between the outlet purifiers and the inlet benzole plant, moving the catch box from its normal working position at outlet of the benzole plant to a position at the outlet CSR plant. Hence the sequence became:

Purifiers ⟶ CSR Plant ⟶ Catch Box ⟶ Benzole Plant.

Connexions were made to the CSR plant, so that this could be placed at the inlet purifiers for working on partially crude gas in conjunction with liquid purification experiments.

The plant (Prov. Pat. No. 5555/44) is illustrated in the photographs (fig. 7), and the cross sectional drawing (fig. 8).

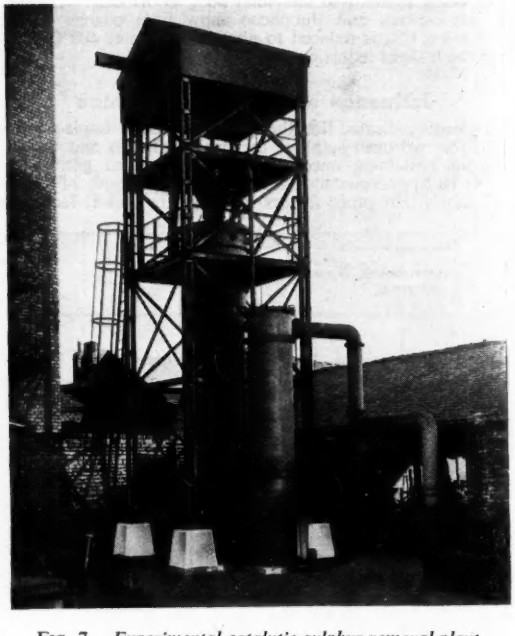


FIG. 7.—*Experimental catalytic sulphur removal plant, Mirfield Gas-Works.*

The gas from the outlet purifiers passes through the steam heater, which is not used, to the heat exchanger unit, being made to pass around the tubes by suitably placed baffles. From the heat exchanger the gas enters a further stage of heat exchange where it is baffled to travel spirally upwards between the outer casing of the converter and the inner steel cylinder. The gas travels thence into the space at the top of the converter, and descends vertically downwards into the space surrounded by an annular basket containing catalyst. The basket is constructed of two concentric cylinders of steel having lipped perforations, which allow unrestricted passage of gas, but retain the solid catalyst. Gas passes through the annular bed in an outward direction, and after leaving the catalyst, travels in a downward direction around the catalyst basket, imparting a considerable amount of heat to the incoming gas ascending the spiral. The gas then enters the heat exchanger proper, passing downwards through the tubes. At the base of the heat exchanger is a header, in which the gas collects, and from this point passes to the tower cooler, where it meets a descending current of cooling liquid, there being direct contact between the two.

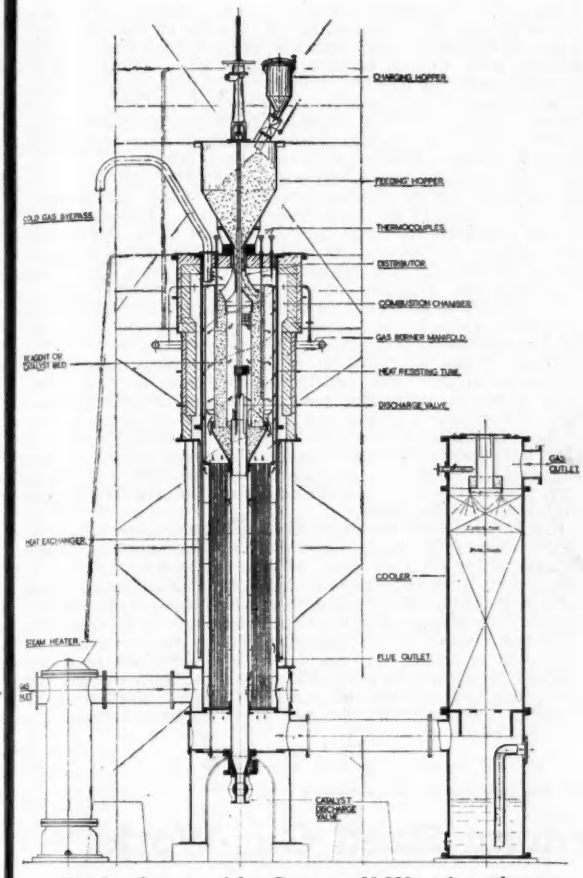


FIG. 8.—*Organic sulphur Converter, 20,000 cu.ft. per hour.*

In this the gas is reduced to normal temperatures before passing forward to the catch box.

Surrounding the upper part of the converter is a combustion chamber fitted with four burners directed tangentially into the combustion chamber. The burners are of British Furnaces, Ltd., tunnel type, and operate on the automatic proportioning principle. The flue gas passes round the converter body in a downward direction, and is discharged to atmosphere near the base.

The converter is surmounted by a catalyst bunker and a charging hopper. Fitted beneath the charging hopper is a distributor pipe for catalyst, which can be operated by a hand-wheel to travel around a vertical axis, so that the distributor pipe can cover every point of the annulus, to ensure that it is completely full of catalyst.

Catalyst is discharged by lowering the discharge valve, which can be operated by the same hand-wheel. When the valve is lowered, catalyst runs from the annulus through the valve into the discharge pipe. When this latter is full the valve can be raised, and the catalyst in the pipe discharged by the cock situated at the base of the discharge pipe. If catalyst is worked through the plant a small quantity at a time, the discharge valve is left in the down position and the catalyst drawn off only by a cock.

The whole of the converter is surrounded by a steel structure, into the roof of which is fitted a travelling block which is sufficient to lift the heaviest portions of the plant. The cooling liquid to the tower cooler is pumped from a stock tank by a Holden & Brook centrifugal pump through a rack cooler to the tower. The liquid leaving the tower collects in a chamber at the base and runs back to the tank by gravity. The air for the gas burners and for other minor duties, such as aeration of the catch box, is supplied by a Connersville blower.

An Arca regulator maintains the temperature of the gas leaving the tower cooler at a constant figure by operating on a by-pass to the rack cooler on the cooling liquid line.

The main control on the plant is the one for maintaining the temperature of the catalyst at a reasonably constant figure, and this operation, which is vital to the successful working of the plant, is carried out by a Kent Floating Proportional Temperature Controller. In plants of the hydrogenation type, temperature control must take account of the unavoidable presence of oxygen in the gas.

In considering the question of control, we decided that this must be capable of handling a wide variation in conditions, particularly oxygen content of the gas, and be independent of manual operation. The basic principle adopted therefore was to accept whatever oxygen content came along with the gas to be treated without any attempt at the adjustment of this figure. The presence of this quantity of oxygen would cause combustion of hydrogen on the catalyst surface, causing a certain known temperature rise. If, owing to this combustion, the temperature of the catalyst is raised too high, some of the gas is by-passed around the heat exchanger to compensate for the excess of heat. On the other hand, if the oxygen content is insufficient to maintain the catalyst temperature, external heating is carried out by the burners. By this means it was found that a constant temperature control could be achieved over a very wide range of oxygen percentages.

The device we use is shown in figs. 9 and 10. On the inlet of the steam heater is fitted a butterfly valve, which can be actuated by a Kent "Selsyn" gear box.

Immediately below the butterfly valve is a 4-in. diameter branch connected by a 4-in. diameter line to the top plate of the converter

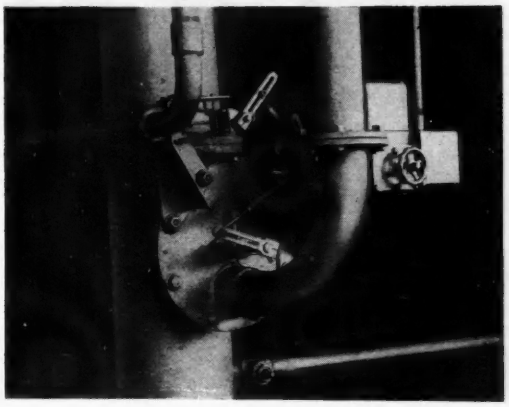


FIG. 9.—*Temperature controller: Selsyn gear-box, butterfly valve, and fuel air valve.*

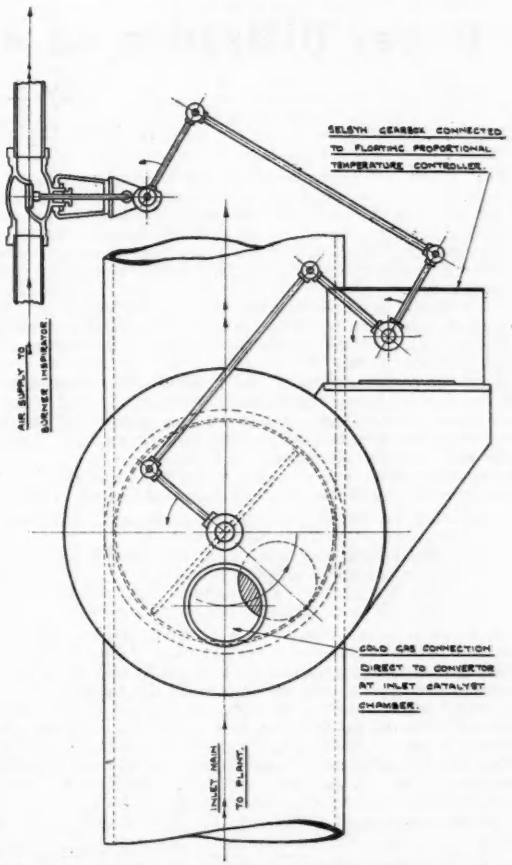

SELSYN GEARBOX CONNECTED TO FLOATING PROPORTIONAL TEMPERATURE CONTROLLER.
AIR SUPPLY TO BURNER INSPIRATOR
COLD GAS CONNECTION DIRECT TO CONVERTOR AT INLET CATALYST CHAMBER.
INLET MAIN TO PLANT

FIG. 10.—*Automatic temperature controller. Selsyn gear-box and butterfly valve.*

FIG. 11.—*Control panel showing Kent controller.*

body. With the butterfly valve in the open position virtually no gas passes through the 4-in. line, all of it going up the 12-in. line to the steam heater and heat exchanger, in the normal way. When the butterfly valve is closed, or partially closed, gas is driven up the 4-in. diameter "cold gas by-pass," thereby reducing the mean temperature of the gas arriving at the top of the converter. Connected to the same Selsyn gear box is a valve in the line carrying air to the pre-mixed burners. The two controls are arranged in such a way that when the butterfly valve is closed fuel air to the burners is off.

The Selsyn gear box which actuates the two valves is in turn operated by a Kent floating proportional temperature controller, which is situated in the control room (fig. 11). This instrument is of the potentiometric type, and is actuated by a thermo-couple situated in the front layer of the catalyst bed. The control temperature can be adjusted inside the instrument. When the catalyst temperature is at the correct position, the operating gear box remains still. If now the temperature rises, the couple transmits an impulse to the controller, which in turn operates the gear box, and the butterfly valve is operated in such a way as to send more gas up the cold gas by-pass. If this is insufficient to check the temperature rise the motion is carried further and the air to the burner is checked as well. If now the temperature tends to fall below the control temperature the flap valve is opened and the fuel air to the burner increased to full. In passing it should be noted that by using this device, the plant has operated for approximately six months without any shift attendant. Although the gas valve as used at Mirfield is described here, it should be pointed out that a more positive arrangement is contemplated in the future.

Finally conditions have been envisaged where there might be a sudden wave of high oxygen gas with which the controller was unable to cope, either from the point of view of speed or intensity. To handle such a situation there is fitted an automatic quick opening valve on the main by-pass to the plant, which is operated by a B.T.H. thruster, also connected to the Kent controller. In the event of an abnormal temperature rise, which might damage the catalyst and plant, the controller on reaching a pre-determined temperature operates the B.T.H. thruster, which opens the main by-pass to the plant, thereby removing the cause of danger. Simultaneously a hooter is blown so that the machinery attendant knows of the condition of affairs.

(*To be continued*)

Power Utilization on a Medium Sized Gas-Works*

By S. ASHWORTH

Resident Engineer, Leyland Gas Company

THE power requirements of gas-works vary considerably for numerous reasons, chief among which are the type of carbonizing plant in use, the manner in which purification, the recovery of by-products, and the working up of these are executed, the layout of the various items of plant, and the proportion of the gas which is compressed or boosted. For example, the weight of steam used has been stated to vary between 800 and 2,000 lb. per ton of coal carbonized. It should be pointed out that these figures include both power and process steam, but it will be realized, particularly in cases where exhaust steam is used for process work, that it is difficult to strike a balance between the two.

During the reorganization of the Leyland works an attempt was made to meet its power requirements by electricity and waste heat steam alone. Some 18,000 tons of coal per annum are carbonized in horizontal retorts at this works, 35% of the gas output of which is compressed to an average pressure of 75 in. W.G.

Power-consuming plant on such a works may be divided into three categories according to the nature of their load factors, as follows:

(*a*) Plant having very low load factors—*e.g.*, retort charging machines, coal and coke handling plant, &c.

(*b*) Plant having reasonably good but variable load factors—*e.g.*, gas compressors and boosters.

(*c*) Plant having high load factors—*e.g.*, exhausters, liquor circulation and water pumps, waste heat boiler fans, &c.

It is essential for the success of a scheme such as ours that the daily load factor of the steam utilizing plant should be as high as possible over the full year, and more particularly that the hourly load factor should be as high as possible over the daily period. We have been helped considerably in the first consideration by the high proportion of industrial gas sold, and by the fact that heavy peak winter loads can be met by Tully complete gasification plants, one of which is more than self-sufficient in steam by virtue of its being fitted with a waste heat boiler. It has been possible, therefore, to work the carbonizing plant under very steady loading, five beds being in operation during the summer period and the full six during the winter months.

* From a Paper to the Manchester and District Junior Gas Association, February 23, 1946.

Plant in category (*a*) could with advantage be driven by purchased electricity, while category (*c*) plant should form the bulk of the steam-consuming equipment.

The outbreak of the Second World War found the Leyland Gas Company with an output of short of 150 million cu.ft. of gas per annum, and a gas-making plant comprising a 500,000 cu.ft. per day installation of stop-ended horizontal retorts together with two Tully complete gasification plants, each with a nominal output of 300,000 cu.ft. of low-quality Tully gas.

Application of Electricity

As is usual in most mechanically-operated horizontal retort installations, the charging and discharging equipment together with the coal and coke handling plant is electrically driven by direct current motors operating at a voltage of 230.

With the exception of the coal elevating and conveying machinery, the load thrown by this plant is of a widely varying nature, subject to rapid increases and decreases caused by the intermittent operation of the charging machine and coke telpher. With steam-driven generating sets it is wellnigh impossible to provide a suitable output current of approximately constant voltage under these conditions. Steady voltage is essential if undue strain on the electrical equipment is to be avoided, but in addition to this it is imperative that the voltage remains constant during the period the coal projector is in operation if good even charges are to be obtained.

It was apparent that even though capital, maintenance, and steam costs were sufficiently low for home generation to be economically sound—and this is very far from being true—the generation of electricity on a works of this kind is unsound on practical grounds alone.

For six months prior to the arrival of a mercury arc rectifier, all the direct current for the retort house was generated by a steam-driven 30-kW. generator. During this period all three available solid fuel-fired boilers had to be kept under fire to provide sufficient reserve of steam to meet the requirements of the generator during charging rounds. The average weekly fuel consumption fell by approximately 21 tons of coke per week on the installation of the rectifier. This fuel, together with the additional labour and other charges, was replaced by an A.C. consumption by the rectifier of some 60 units

per day. The total cost of the rectifier, including its installation, amounted to £315, a figure which was repaid in the matter of a few weeks by the economies effected. It has been found that by means of electrical power supplied through the rectifier, coal can be elevated, stored in overhead bunkers, charged into the retorts, and the resultant coke discharged and conveyed to the coke storage yard for a cost in power of 1.34d. per ton, or 0.019d. per therm of gas made.

The efficiency of the mercury arc rectifier is about 95%, the maximum value being at three-quarter load, but it falls off very appreciably below one-quarter load. Care should therefore be taken to see that the size of a rectifier is so chosen that the maximum amount of work is done with the rectifier working above this figure. Advantage should not be taken of the low capital cost of this equipment to plan on a long-term basis, and install a rectifier sufficiently large to meet possible future additional D.C. loads. Future demands should be met as they occur by the installation of additional bulbs working in parallel.

Maintenance costs for this apparatus are negligible, and during the twenty months that our particular rectifier has been in operation, the only attendance has been the occasional cleaning of the switchgear and circuit breaker.

Steam Generation and Distribution

The Leyland works is equipped with three solid fuel-fired boilers of a varied nature, namely, a 20 ft. by 7 ft. Lancashire boiler, a 12 ft. by 5½ ft. Cornish boiler, and 1,500 lb. per hour Cochran vertical boiler. During the six months prior to the installation of the mercury arc rectifier, sufficient reserve of steam to meet the heavy requirements of the generating set during charging periods could only be obtained by firing all three boilers—a somewhat disconcerting position to be in on receipt of a letter from our insurance company to the effect that the Lancashire boiler was due for internal examination! Luckily Easter week-end was at hand, and the opportunity was taken to carry out the examination at the expense of completely stopping all retort house operations for a period of 24 hours.

The arrival of the rectifier enabled the Cornish and vertical boilers to be immediately shut down and a more normal state of affairs to prevail. In the meantime work had been going ahead with the building of a new waste heat boiler house and the installation of the boiler itself.

Many of the larger sized works have well-equipped and efficiently run waste heat boiler installations, but there would appear to be some doubt in the Industry as to the soundness of such waste heat recovery on smaller horizontal installations. Perhaps the three chief reasons for this are:

(*a*) The fact that partial recovery of waste heat is practised in the recuperators, with a consequent lower figure for the heat available for recovery in waste heat boilers.

(*b*) The apparent difficulty in many instances of obtaining waste gases of a reasonably high temperature and carbon dioxide content.

(*c*) The availability on many works of a supply of low-grade cheap fuel in the form of coke breeze.

The first of these reasons must be accepted if recuperation is to be practised, but a good deal can be done to mitigate the second by careful maintenance of the recuperators and flues, and by regular and painstaking regulation of primary and secondary air slides and waste gas dampers.

The third reason is of a more debatable nature. The cheapness or otherwise of steam should be assessed by the actual duty performed, and not by the cost at which it can be delivered from the boiler stop valve. The higher the efficiency of utilization, the less weight of steam is required from the boiler plant, and if standing charges and labour costs remain constant, the apparent cost of steam generation per unit of water evaporated is correspondingly increased. Where the steam requirements per ton of coal carbonized are low—for example, our figure at the time of writing is less than 800 lb., making a total daily requirement of in the region of 40,000 lb.—the labour costs alone, assuming one boiler firer is required for each of the three shifts, would amount to 1s. 5d. per 1,000 lbs.

There is an increasing demand for the smaller sizes of coke, high prices being obtained for sized coke screened from what has been regarded hitherto as coke breeze. By careful screening and a development of the market for the lower sizes, the weight of breeze available for the works boilers will be progressively reduced. At the same time the increasingly high content of "fines" reduces its value as a fuel. Heavy clinker formation is particularly liable to occur with the small sizes, while the carry-over of dust into the flue system may attain alarming proportions. If breeze alone is burnt the boiler plant must be of ample proportions, with ample grate areas corresponding to combustion rates of between 20 and 35 lb. of breeze per sq.ft. per hour.

At Leyland, the coke screening plant having not yet been erected and there being consequently no coke breeze available, it was the practice to burn run-of-retort coke on the solid fuel-fired boilers. With a price of 55s. per ton and an evaporation of 7 lb. of water per lb. of fuel, the cost of fuel would amount to 3s. 6d. per 1,000 lb. of steam generated. If a supply of breeze were available with an evaporation of 5 lb. of water per lb. of fuel and the breeze costed at 18s. per ton, fuel costs would amount to 1s. 7d. per 1,000 lb. of steam. It will be seen therefore that in our particular case fuel and labour costs alone amount to no less than 4s. 11d. per 1,000 lb. of steam when using coke, and 3s. when burning breeze—figures which can hardly be included under the heading of "cheap steam."

At the time of starting up the waste heat boiler, the steam requirements of the works amounted to some 2,600 lb. per hour and, as the rated capacity of the boiler was 2,700 lb. per hour, steps were taken to increase the output of the boiler by augmentation to a point at which it would give us the full steam requirements. In view of the fact that we had previously been generating our steam by run-of-retort coke, we could have no qualms about this augmentation, which transferred the combustion of the coke from the Lancashire boiler to the producers, with the consequent saving in labour and the conversion of the heat of the fuel into steam under conditions of high efficiency. The release of three boiler firers and their availability for the reconstruction work which was being carried out was then of far greater value than the mere saving of their total wages.

Assessing Steam Values

It may not be out of place to mention some of the features peculiar to the Cochran "Sinuflo" waste heat boiler installed at Leyland. The most salient of these is that the design of the "Sinuflo" tubes allows a reduction in the length of the tubes or an increase of the diameter, or a combination of these two advantages. Hot gases impinging on a surface give up their heat much more readily than do gases at the same temperature passing along parallel to the surface. Due to the shape of the "Sinuflo" tube, the gases are constantly impinging first on one side and then on the other, and in doing so they effect a scrubbing action which removes the layer of more or less stagnant gases which would otherwise cling to the heating surfaces. In addition, the turbulence set up ensures that the core of hot gases in the centre of the stream is broken up and brought into contact with the wall of the tube. Similar results can only be obtained with straight tubes by the use of much higher gas velocities. A larger bore tube has in itself the advantages that it is easier to clean, it can be expanded more satisfactorily into the boiler tube-plate, and it is not adversely affected to the same extent by dirt or deposit forming in the tube. The advantages of shorter length include greater ease in cleaning, less pressure drop in the gases due to friction, and less tendency for trouble to develop because of the tubes sagging or vibrating. The Leyland boiler is only 9 ft. 7½ in. between the tube plates, as against 15 ft. 6 in. for a straight tube boiler of similar capacity. The pressure drop across the boiler is very low, being of the order of eight-tenths of an inch W.G. The paddle type Sturtevant fan supplied with the boiler is driven by a 15 h.p. Sissons vertical high-speed engine.

Immediately the waste heat boiler had been put into commission a survey was made of the existing steam distribution system. This was of a particularly haphazard nature, and it was apparent that a large amount of heat was being dissipated into the atmosphere from it, both from leakages and radiation from unlagged surfaces. It was impossible to obtain order out of chaos with the existing steam mains, and a decision was made to erect a completely new distribution system. In designing the system, due attention was given to the following points:

(*a*) Steam was to be delivered at the points of utilization by the shortest practicable route.

(*b*) Correct drainage of the mains was allowed for with the provision of efficient traps to remove any condensate from the drainage points.

(*c*) Allowance was made for expansion of the main to take place.

(*d*) All steam supplies to the individual prime movers were taken from the top of the main to prevent interference with drainage and to ensure dry steam at the engine stop valves.

The complete system, including all flanges and valves, was lagged with a 1-in. blanket of glass silk followed by a ½-in. layer of armouring cement. The efficiency of such lagging is stated to be 91%, representing a saving in heat equivalent to 300 lb. of superheated steam at 400°F. and 110 lb./sq.in. per hour.

Increased Efficiency

Prior to this reconstruction and reorganization, conservative estimates showed that some 2,000 lb. of steam were being used per ton of coal carbonized. This was an extremely high figure considering the work obtained from it, there being none used for benzole extraction or other process work. The substitution of purchased electricity for the costly and impracticable home-generated current reduced the figure considerably to the region of 1,200 lb. The design and erection of a completely new system of steam distribution mains together with their efficient insulation, coupled with the use wherever possible of slow-speed reciprocating engines, greatly increased the efficiency of utilization such that in November, 1945, steam consumption had fallen to 670 lb. per ton of coal carbonized. This figure was appreciably lower than that available from the waste heat from the settings, and it was found possible to meet the requirements of a new benzole plant and provide power for pumping water from the surplus. For the twelve months ended December 31, 1945, coke and breeze available for sale per ton of coal carbonized amounted to 11.89 cwt., and for the months of November and December, 1945, when the erection and insulation of the steam range had been finally completed, this figure had increased to 12.73 and 12.80 respectively.

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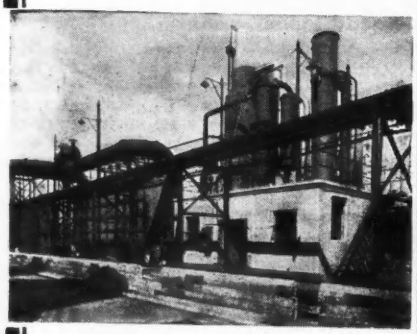

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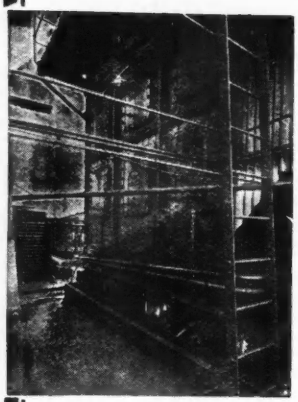

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Products Prices—Stocks and Shares

The London Market Mar. 18.

There are no changes to report in the prices of Coal Tar products, the majority of which are controlled either by Government Order or by agreements.

The following are controlled by Government Orders at the prices indicated:—

Road tar at 5¼d. per gallon filled into buyers' tanks at sellers' works, with corresponding prices when delivered and when supplied in packages.

The price sprayed direct on to roads is controlled by agreement and is 8¼d. per gallon for full tank loads in London and adjacent counties.

Creosote for hydrogenation is based on 5.875d. per gallon and creosote for timber preservation on 5¼d. per gallon *ex* sellers' works, with the usual extras for different qualities, packages, &c.

The basic price for cresylic acid is 3s. 6d. to 5s. per gallon, according to grade.

Hot pressed naphthalene costs £11 11s. in bulk *ex* distillers' works. Prices for refined naphthalene vary from £20 15s. per ton for crystal on 50-ton contracts to £26 15s. per ton for ball and flake. These prices are delivered England and Wales in 2-cwt. bags, minimum 4-ton lots.

The maximum prices for coal tar naphtha vary from 1s. 11d. to 2s. 11d. per gallon and for xylol from 3s. 3½d. to 3s. 6d. per gallon delivered buyers' address in minimum 1,000-gallon lots in bulk. The maximum price for pure toluene is 3s. 2¼d. per gallon in bulk *ex* sellers' works.

The following prices are controlled by agreements:—

Pitch for briquetting is 70s. per ton *ex* sellers' works in bulk.

Phenol is 9½d. to 11½d. per lb. in large returnable drums delivered buyers' address, according to quantity.

The Provinces Mar. 18.

The average prices of gas-works products during the week were: Pitch, 70s. per ton; toluole, naked, North, 90's, 2s. 4d. to 2s. 6¼d. per gallon; pure, 3s. 2¼d. Prices for carbolic acid 60's, anthracene, creosote oil (hydrogenation), coal tar oils (timber preservation, &c.), and strained anthracene oil are controlled by S. R. & O. 1943, 1538, and for naphthalene by S. R. & O. 1944, 1051. Prices for road tar were increased by a half-penny per gallon by S. R. & O. 1945, 229, under which Order there was also an increase of 5s. per ton in the price for standard creosote-pitch mixture.

The bulk of the pitch produced in this country is required for home trade purposes, but certain quantities are being sent at higher prices to Allied countries with the approval of the Coal Tar Control. So far as creosote is concerned the bulk is required for essential purposes, at controlled prices. With regard to hydrocarbon oils, the prices remain fixed, although there is more freedom than was previously the case.

Scotland Mar. 16.

Demand continues active with prices firm. Refined tar*: Yield to the Distillers is 5d. per gallon *ex* Works, naked. Creosote oil: Timber preserving quality,* 5¼d. to 6¼d. Hydrogenation oil,* 5⅞d.; low gravity or virgin oil,† 7¼d. to 7½d.; benzole absorbing oil,* 6¼d. to 8d. per gallon. Refined cresylic acid* is 3s. 6d. to 4s. 6d. per gallon *ex* Works, naked, according to quality. Crude naphtha†: 7d. to 8d. per gallon. Solvent naphtha*: Basic maximum prices delivered in bulk, 90/160 grade, 2s. 10d., and 90/190 Heavy naphtha, Unrectified, 2s. 0½d.; Rectified, 2s. 4d. per gallon. Pyridine†: 90/160 grade, 13s., and 90/140 grade, 15s. per gallon.

* Price controlled. † Uncontrolled.

The international political situation overshadowed Stock Exchange affairs last week, and the volume of business was on a reduced scale. Prices of all British Funds drifted downwards, but the falls were heaviest among those industrials and more speculative shares which had recently made good improvement.

There was a fair amount of business recorded among Gas Stocks and Shares, with prices on the whole remaining firm. It will be seen that several upward movements occurred, especially in the Supplementary List and at the Provincial Exchanges, the only small reactions of note being those of Gas Light units and South Metropolitan Ordinary.

The following were the price changes during the week:

OFFICIAL LIST

Alliance & Dublin Ord. (x.d.) ...	120—125	Mar. 11
Associated Gas & Water 4½ p.c. Red. Cum. Pref. (x.d.) ...	20/—22/—	"
Ditto 4 p.c. Red. Cum. Pref. (x.d.) ...	19/—21/—	"
Ditto 4 p.c. Cum. Pref. (x.d.)	19/—20/—	"
British Ord. (x.d.)	120—125	"
Gas Light Units	21/3—22/3	—/3d.
Imperial Continental Ord.	110—115	+1
Montevideo	116—121	—2
Oriental	207—212	+1½
Primitiva Holdings Ord.	11/6—12/6	—/6d.
Severn Valley 4½ p.c. Cum. Pref. (x.d.)	20/—22/—	Mar. 11
South Metropolitan Ord.	91—94	—1

SUPPLEMENTARY LIST

East Surrey 6 p.c. Cum. Pref. ...	122—127	+3
Hampton Court Cons.	107—112	+2
Plymouth & Stonehouse 5 p.c. Deb. (x.d.)	115—120	Mar. 11

PROVINCIAL EXCHANGES

Bath Cons. (x.d.)	112—114	Mar. 4
Hartlepool Ord.	99—101	+3½
Liverpool 4 p.c. Red. Deb.	102—104	+1½

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